Easy, Medium and Hard MCQs, Numerical Questions & Answers on Topic: Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy.

☰ Content Type	Questions and Answers
Status	Done
☰ Chapter	Gaseous State
☰ Course	Graduation
☰ Reference	
☰ Subject	Physical Chemistry
☰ Topic	
Ruhul Amin	@February 4, 2023 5:51 PM
# Progress (%)	100
☰ Difficulty Level	Medium
☰ Mistake type	
☰ Previous Year Questions	

MCQs: Easy

❓ Which of the following is NOT a velocity distribution according to the Maxwell distribution?
A) Average velocity
B) Root mean square velocity
C) Most probable velocity
D) Median velocity
Answer: D) Median velocity

❓ The Maxwell distribution is a probability distribution for:
A) Pressure
B) Temperature
C) Velocity
Answer: C) Velocity

❓ What does k in the Maxwell distribution formula represent?
A) Boltzmann's constant
B) Avogadro's number
C) Ideal gas constant
Answer: A) Boltzmann's constant

❓ The Maxwell distribution is valid only for:
A) Ideal gases
B) Real gases
C) Liquids
Answer: A) Ideal gases

❓ The Maxwell distribution is used to calculate the:
A) Average velocity of a gas molecule
B) Average pressure of a gas
C) Average temperature of a gas
Answer: A) Average velocity of a gas molecule

MCQs: Medium

❓ What is the relationship between the average velocity and root mean square velocity of a gas molecule according to the Maxwell distribution?
A) Average velocity = root mean square velocity
B) Average velocity > root mean square velocity
C) Average velocity < root mean square velocity
Answer: C) Average velocity < root mean square velocity

❓ What is the relationship between the average velocity and most probable velocity of a gas molecule according to the Maxwell distribution?
A) Average velocity = most probable velocity
B) Average velocity > most probable velocity
C) Average velocity < most probable velocity
Answer: C) Average velocity < most probable velocity

❓ What is the relationship between the root mean square velocity and most probable velocity of a gas molecule according to the Maxwell distribution?
A) Root mean square velocity = most probable velocity
B) Root mean square velocity > most probable velocity
C) Root mean square velocity < most probable velocity
Answer: B) Root mean square velocity > most probable velocity

MCQs:Hard

❓ What is the equation for the probability density function of the Maxwell distribution?
A) f(v) = (m/2kT)^(3/2) * 4πv^2 * e^(-mv^2/2kT)
B) f(v) = (2/πkT)^(3/2) * v^2 * e^(-v^2/2kT)
C) f(v) = (m/πkT)^(3/2) * v^2 * e^(-mv^2/2kT)
Answer: A) f(v) = (m/2kT)^(3/2) * 4πv^2 * e^(-mv^2/2kT

What is the average kinetic energy of a gas molecule according to the Maxwell distribution?

A) (1/2)mv^2

B) (3/2)kT

C) (5/2)kT

Answer: B) (3/2)kT

The average kinetic energy of a gas molecule is proportional to what quantity?

A) The square of the root mean square velocity

B) The square of the most probable velocity

C) The temperature

Answer: C) The temperature

What is the relationship between the temperature and the average kinetic energy of a gas molecule?

A) The temperature is proportional to the square of the average kinetic energy

B) The temperature is proportional to the average kinetic energy

C) The average kinetic energy is proportional to the temperature

Answer: C) The average kinetic energy is proportional to the temperature

What is the relationship between the root mean square velocity and the average kinetic energy of a gas molecule?

A) The root mean square velocity is proportional to the square root of the average kinetic energy

B) The root mean square velocity is proportional to the average kinetic energy

C) The average kinetic energy is proportional to the square of the root mean square velocity

Answer: C) The average kinetic energy is proportional to the square of the root mean square velocity

❓ What is the relationship between the most probable velocity and the average kinetic energy of a gas molecule?

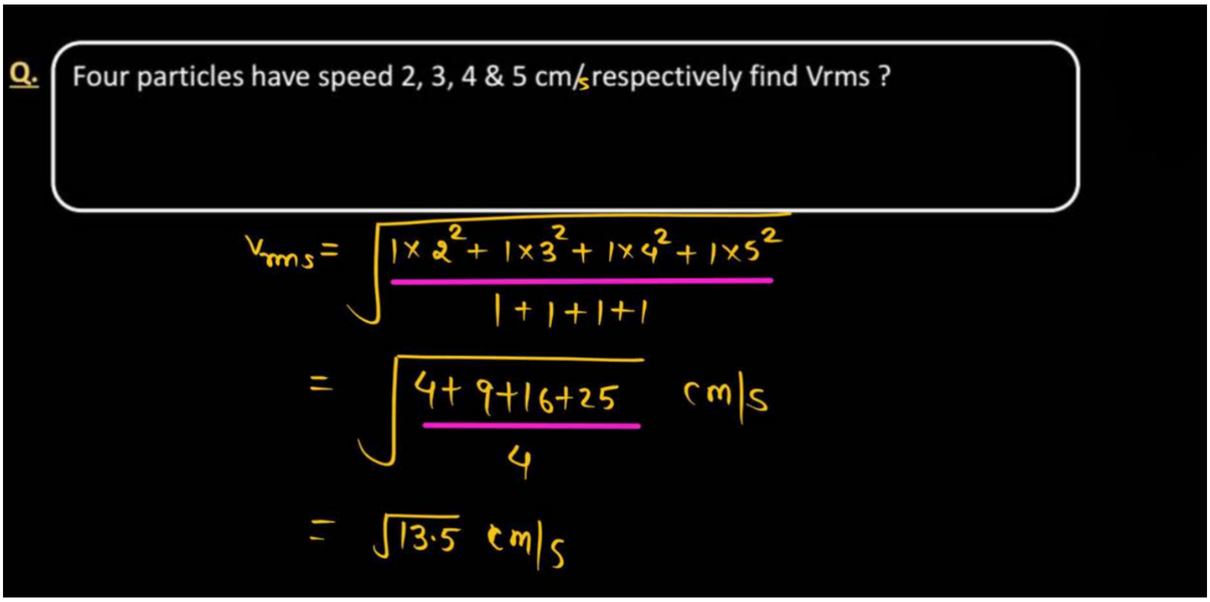
A) The most probable velocity is proportional to the square root of the average kinetic energy

B) The most probable velocity is proportional to the average kinetic energy

C) The average kinetic energy is proportional to the square of the most probable velocity

Answer: C) The average kinetic energy is proportional to the square of the most probable velocity

Numeral Based Questions

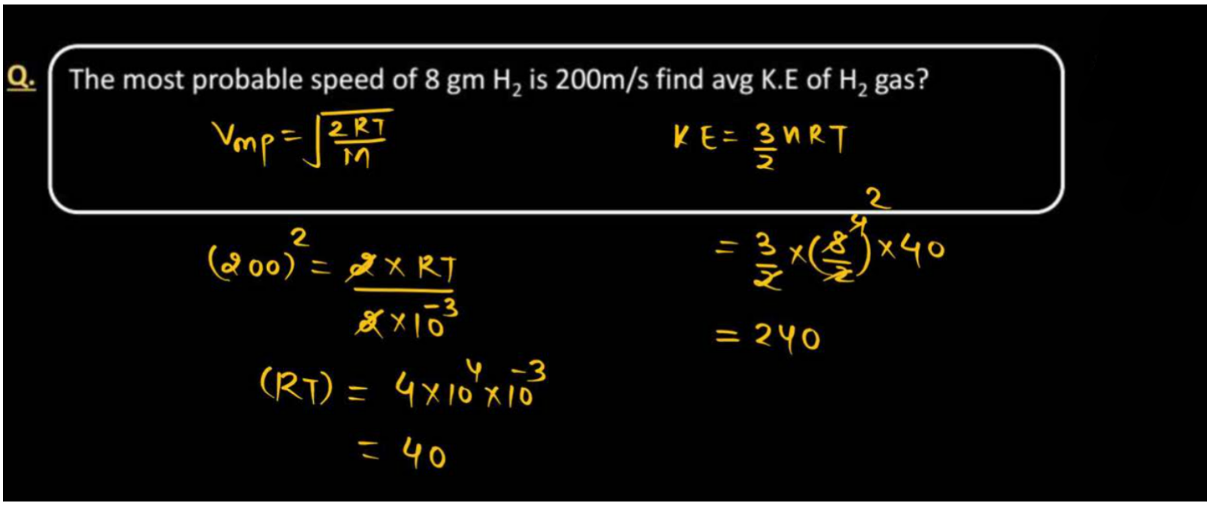


Q. Four particles have speed 2, 3, 4 & 5 cm/s respectively find Vrms ?

$$V_{rms} = \sqrt{\frac{1\times 2^2 + 1\times 3^2 + 1\times 4^2 + 1\times 5^2}{1+1+1+1}}$$

$$= \sqrt{\frac{4+9+16+25}{4}}\ cm/s$$

$$= \sqrt{13.5}\ cm/s$$



Q. The most probable speed of 8 gm H_2 is 200m/s find avg K.E of H_2 gas?

$$V_{mp} = \sqrt{\frac{2RT}{M}} \qquad KE = \frac{3}{2}nRT$$

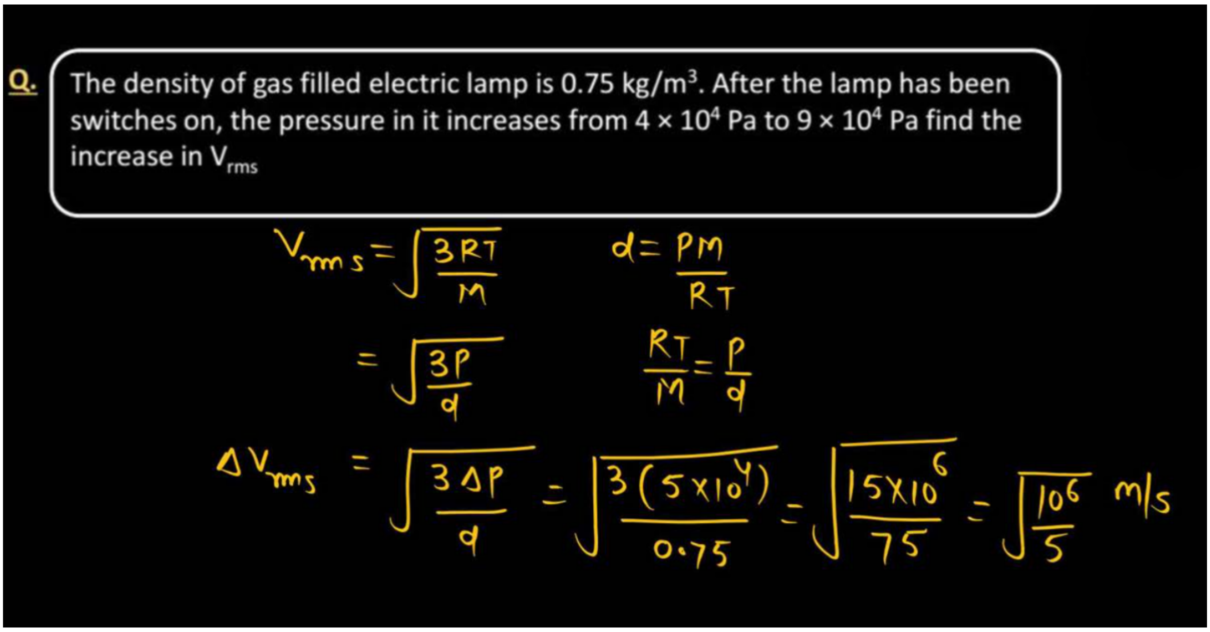
$$(200)^2 = \frac{\cancel{2}\times RT}{\cancel{2}\times 10^{-3}}$$

$$(RT) = 4\times 10^{4}\times 10^{-3}$$

$$= 40$$

$$= \frac{3}{\cancel{2}}\times\left(\frac{\overset{\overset{2}{\cancel{4}}}{\cancel{8}}}{\cancel{2}}\right)\times 40$$

$$= 240$$

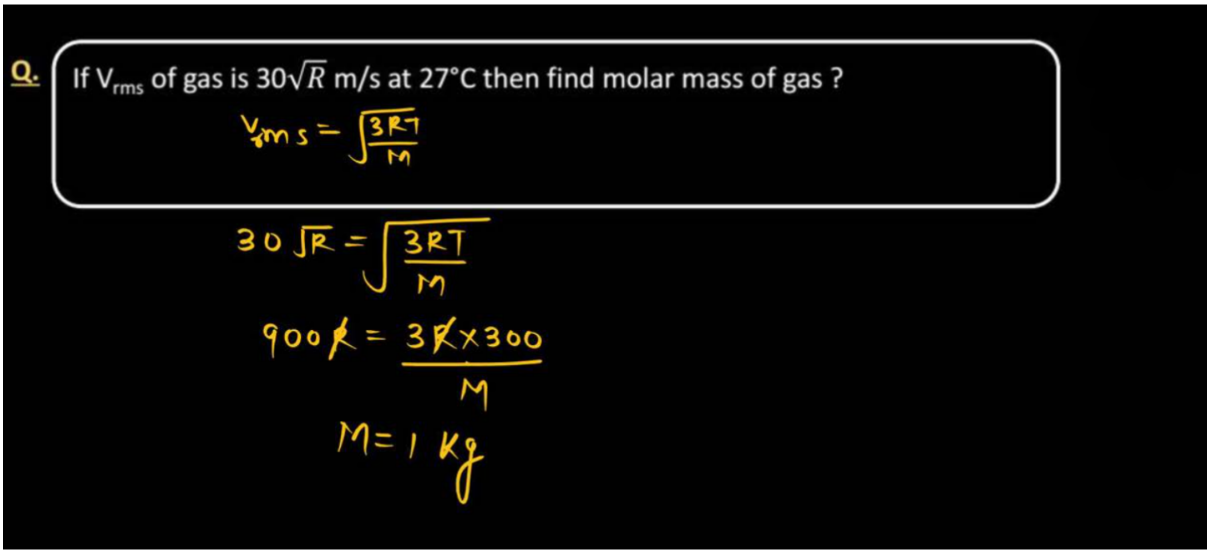


Q. The density of gas filled electric lamp is 0.75 kg/m³. After the lamp has been switches on, the pressure in it increases from 4×10^4 Pa to 9×10^4 Pa find the increase in V_{rms}

$V_{rms} = \sqrt{\frac{3RT}{M}}$ $d = \frac{PM}{RT}$

$= \sqrt{\frac{3P}{d}}$ $\frac{RT}{M} = \frac{P}{d}$

$\Delta V_{rms} = \sqrt{\frac{3\Delta P}{d}} = \sqrt{\frac{3(5\times10^4)}{0.75}} = \sqrt{\frac{15\times10^6}{75}} = \sqrt{\frac{10^6}{5}}$ m/s



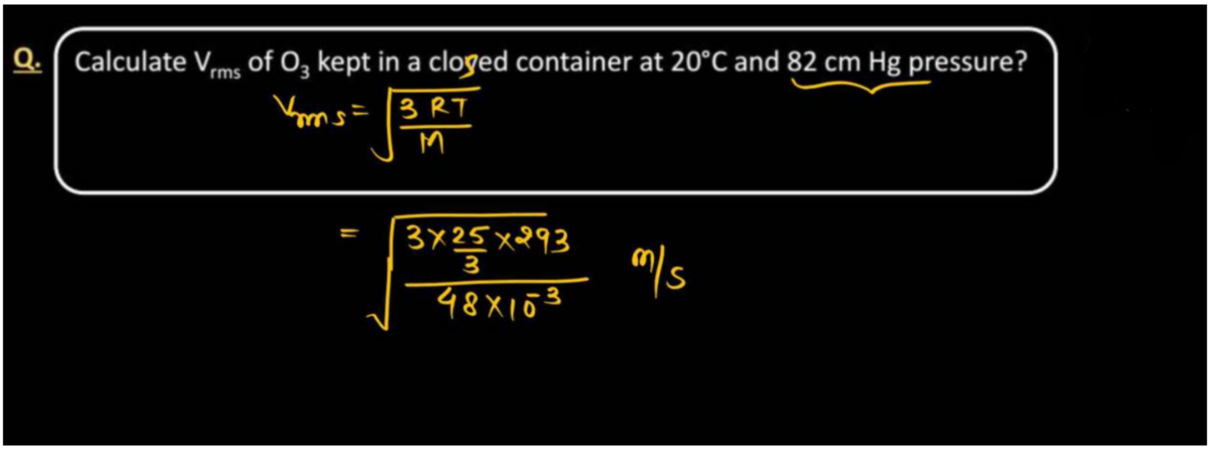
Q. If V_{rms} of gas is $30\sqrt{R}$ m/s at 27°C then find molar mass of gas ?

$V_{rms} = \sqrt{\frac{3RT}{M}}$

$30\sqrt{R} = \sqrt{\frac{3RT}{M}}$

$900\cancel{R} = \frac{3\cancel{R}\times300}{M}$

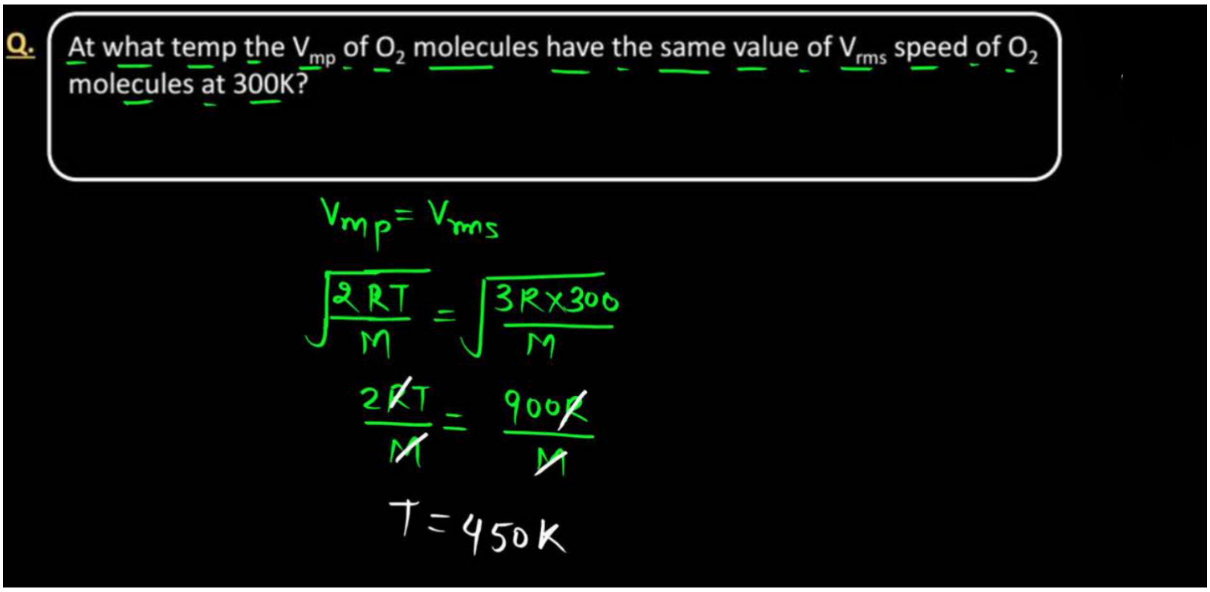
$M = 1$ Kg



Q. Calculate V_{rms} of O_3 kept in a closed container at 20°C and 82 cm Hg pressure?

$V_{rms} = \sqrt{\frac{3RT}{M}}$

$= \sqrt{\frac{3\times\frac{25}{3}\times293}{48\times10^{-3}}}$ m/s



Q. At what temp the V_{mp} of O_2 molecules have the same value of V_{rms} speed of O_2 molecules at 300K?

$$V_{mp} = V_{rms}$$

$$\sqrt{\frac{2RT}{M}} = \sqrt{\frac{3R\times300}{M}}$$

$$\frac{2\cancel{R}T}{\cancel{M}} = \frac{900\cancel{R}}{\cancel{M}}$$

$$T = 450K$$